

Experimental and phenomenological comparison between Piezonuclear reactions and Condensed Matter Nuclear Science phenomenology.

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Abstract

The purpose of this paper is to place side by side the experimental results of Piezonuclear reactions, which have been recently unveiled, and those collected during the last twenty years of experiments on low energy nuclear reactions (LENR). We will briefly report the results of our campaign of piezonuclear reactions experiments where ultrasounds and cavitation were applied to solutions of stable elements. These outcomes will be shown to be compatible with the results and evidences obtained from low energy nuclear reaction experiments. Some theoretical concepts and ideas, on which our experiments are grounded, will be sketched and it will be shown that, in order to trigger our measured effects, it exists an energy threshold, that has to be overcome, and a maximum interval of time for this energy to be released to the nuclear system. Eventually, a research hypothesis will be put forward about the chance to raise the level of analogy from the mere comparison of results up to the phenomenological level. Here, among the various evidences collected in LENR experiments, we will search for hints about the overcome of the energy threshold and about the mechanism that releases the loaded energy in a suitable interval of time.

1 Evidences of Piezonuclear reactions

All of the experiments that we have carried out, involved the application of ultrasounds with a frequency of 20 kHz and suitable power (most of the times around 100 W) to liquids. These liquids were either bidistilled deionised water [1, 2, 3] or solutions of bidistilled-deionised water and some standard chemical elements [4, 5]. In the two experiments reported in [1, 2] samples of bidistilled and deionised water were subjected to cavitation¹ for different intervals of time: 210 minute long cavitation induced an increase of the proportion of a few high mass number stable isotopes (including uranium); four successive cavitations, each one lasting for 10 minutes, with 15 minutes between a cavitation and the next one, gave rise to an increase of the proportion of a few nuclear species within the particular atomic mass range $238 < M < 264$ (including transuranic elements). In the third experiment [3], aimed at detecting elements in the so-called rare-earth mass range, ICP mass spectrometry of the solution was performed during five successive cavitations, each one lasting for 15 minutes (with 15-minutes intervals between a cavitation and the next one). The ICP-MS analysis gave evidence of a significant peak corresponding to a nuclide with atomic mass (137.93 ± 0.01) amu and half-life 12 ± 1 sec, identified as Eu_{63}^{138} . It is known that the abundance on Earth of stable Eu is less than 1.06 ppm (the natural Eu is a mixture of two isotopes, Eu_{63}^{151} with a percentage abundance of 47.77% and Eu_{63}^{153} with a percentage abundance of 52.23%). The candidate identified during the third experiment, Eu_{63}^{138} , does not exist in nature; it is an artificial radionuclide (discovered in 1995-97 [6]) that can be produced at the present time in nuclear reactors and by synchrotrons. There are two ways whereby Eu_{63}^{138} can be produced: by nuclear fission or by nuclear fusion. The former process requires less energy. However, from the results of the first two experiments, the quantity of heavy nuclei, which can produce Eu_{63}^{138} by nuclear fission, is much smaller (by two-three orders of magnitude) than that of the intermediate nuclei that can produce it by fusion. It turns out that fusion intermediate of elements is more likely and besides it is the only possible explanation of the changes in concentration of stable elements, induced by cavitation, observed in the first experiments². The ionising radiation measurements, by LR115 detectors, that were carried out during the application of ultrasounds in all of these experiments, did not provide any evidence of ionising radiation above the background level. Further experiments were designed in order to try and detect possible neutron emission. We subjected to cavitation, bidistilled deionised water, solutions of Lithium, Aluminium, and Iron. No evidences of neutrons were collected with water Lithium and Aluminium.

¹It is necessary to warn the reader that ultrasounds and cavitation do not have to be read as the mean to produce hot fusion confined in a collapsing bubble as it was for other experiments conducted by other teams. In the third paragraph the differences between our scope and their will be clarified

²The words fission and fusion have been used here. However, it is becoming evident that the outcomes of these piezonuclear reactions experiments, along with those involving low energy nuclear reactions, have nothing to do with the established definitions of fission and fusion. In this sense, these two words have to be interpreted as disintegration of nuclei and union of nuclei respectively. In the following other words will be used like nucleolysis and nucleosynthesis

Iron, conversely, did produce neutrons every time and the mutually exclusive experiments stressed that, being equal all the experimental conditions, it was just the presence of Iron to bring about emission of neutrons. Quite bewilderingly, such a heavy and stable element³, whose Coulomb barrier is huge, was the trigger of unusual neutron emission⁴. A further unusual circumstance was the lack of the gamma radiation that usually comes along with the emission of neutrons. A further experiment was performed in order to verify the effects of these new mechanisms induced by ultrasounds and cavitation on radioactive nuclei [7, 23, 24]. The evidences indicated that the initial quantity of Thorium became half in a interval of time 10000 times faster than Thorium half life. However it turned out that this process was not a mere acceleration of the usual Thorium decay by emission of alpha particles, since the number of tracks on the CR39 detectors that monitored the radioactive process was not compatible with this possibility.

2 Evidences of Low Energy Nuclear reactions

More than 20 years have gone since the first announcement of Cold Fusion by Martin Fleischmann and Stanley Pons. Since then, despite the aversion that this subject received, an incredible amount of experiments have been carried out in order to reproduce the announced cold fusion effects. Different techniques have been tested and great improvements in reproducibility have been achieved. We will try and group the apparently anomalous results obtained during these years in order to point out the possible analogies among these outcomes and those collected in the experiments of piezonuclear reactions. Since the goal of this paper is only to show a new possible perspective and promote discussion on it, comprehensiveness is not our main target. In order to summarize the results we will refer to the book "The Science of Low Energy Nuclear Reactions" by Edmund Storms [8]. Independently from the the method used to induce LENR (Electrolyte, Plasma, Laser, Diffusion, Fuse, Ambient, Bombard, Biological) it becomes clear that in all of experiments there were clear signs of transmutations and that most of the times the resulting products were Iron, Zinc Copper, Nickel, Chromium and other nuclides with comparable mass and binding energy per nucleon (none of them can be considered a light element). Besides, the nuclides belonging to the substrates used in all of the experiments had considerable atomic mass ranging from 48 amu for Ti or 58 amu for Ni up to Pd with 106 amu and further on to W with 184 amu and Au with 197 amu. As to the environment in which the substrate was immersed, it contained different substances and chemical compounds which contained much lighter nuclides like H, D, Li, Na, K, C, N, O, Cl, and sometimes other heavier ones compatible with the atomic mass of the nuclides of the substrate. Both in piezonuclear reactions experiments and in LENR experiments there are transmutations

³Iron is at the top of the curve binding energy per nucleon.

⁴Neutrons were detected by different techniques: bubble detectors, CR39 with Boron layer, Boron Trifluoride. The evidences collected were compared with neutron signals from standard sources (AmBe) and fast neutron nuclear reactor

that involve heavy mass number nuclides and produce other intermediate and heavy mass number nuclei⁵. These transmutations took place neither by fusion (Coulomb barriers would be too high) nor by fission since the evidences did not show any signs typical of these reactions, like neutron emission or prompt gamma rays or presence of easily detectable radionuclides⁶. In LENR neutron emission was very low and infrequent while in piezonuclear reactions it was not infrequent but nevertheless it was low and certainly not compatible with known nuclear reactions, first of all because of the lack of prompt gamma rays and second because no gamma rays from neutron capture by hydrogen was detected either. As to other kinds of radiation emitted during LENR, many different types were detected, which, however have not help in identifying clear common features among the different experiments and techniques. Among all of them it is worth noting that some teams detected a strange radiation showing unknown features and behaviour [8, 9] which, from our point of view, could be put beside the strange lack of gamma rays which, at least from hydrogen neutron capture, should be emitted. As it will become clear from the next section, it was not our goal to perform extra power or heat measurements during piezonuclear reaction experiments, and hence no comparison can be made on this ground.

3 Local Lorentz Invariance Breakdown

The theoretical background, on which our experiments have been designed and carried out, is based on the concept of breakdown of Local Lorentz Invariance (LLI) [10, 11]. LLI is a symmetry of the laws of Physics which locally, i.e. in a sufficiently small region of space-time, have to stick to the framework of Special Relativity [12]. This statement has some interwoven consequences on the mathematical form of the laws and on the structure of local space-time. Our theory concentrates on the structure of local (microscopical) space-time (flat and rigid according to LLI) when LLI is broken. The theory has been built from a phenomenological basis, in the sense that the coefficients of the local Minkowski metric tensor are hypothesized to be function of the energy of the process. The form of these functions have been determined by analysing through this formalism possible anomalous outcomes of experiments probing different fundamental interactions. The dependence of the metric tensor on the energy of the physical process means that local space-time is certainly no more rigid and moreover that its geometry can be deformed, just like a blanket which can be furrowed and creased by the energy of a hand. The main consequence of this locally deformed space-time is that it takes an active part in the dynamics of the physical process whose features and flow deeply depart from their usual appearance. The theory predicts that the space-time of strong interactions begins to be deformed when

⁵In piezonuclear reactions the heavy nuclides which can be placed side by side to the LENR substrate are those contained in the alloy of the sonotrode

⁶Of course, being neutrons very rare in both of the type of reactions transmutations by neutron capture are ruled out as well or at least very unlikely.

the energy of the process overcomes a threshold of energy equal to 367.5 GeV [10, 11]⁷. Besides it clearly states that there is no isochrony between the time of the experimenter and that of the hadronic process. To put it in a more practical way, this means that in order to deform space-time around a nucleus (or nuclei) and hence trigger "anomalous" processes, in the fashion of those presented above from piezonuclear reactions, one has to find a microscopical mechanism that loads an amount of energy higher than the energy threshold and then it is capable to release it in a suitable interval of time or in other words it is capable of a suitable power (energy divided by time). This theoretical background shows that our experiments was not in wake of the LENR ones, but their target was to obtain some evidences that would corroborate the two predictions mentioned above about the threshold energy and the release mechanism⁸.

4 LLI and anomalous nuclear processes

It has been shown that the results of LENR experiments and those of piezonuclear reactions are compatible. Thus, despite the apparent diversity of the experimental setups and conditions, it is possible to hypothesize that similar outcomes are brought about by similar microscopical mechanisms that trigger alike anomalous nuclear processes. Now, let us evidence the phenomenological aspects that, within piezonuclear experimental setups, fulfill the two conditions mentioned above. Once that these aspects are clear we will try and analyze some LENR setups and evidences in order to make out similar features.

First of all it is important to state that piezonuclear reactions have nothing to do with sonofusion despite the common starting point, i.e. ultrasounds and cavitation. The two research tracks diverge from the theoretical, phenomenological and experimental points of view [14]⁹. The collapse of a generic bubble under the huge pressure of ultrasounds, that induces shock-waves on its surface, is regarded as the microscopical mechanism to fulfil the two requirements. Let us recall the evidences obtained in the experiments where neutron emission has been detected [4, 5]. We subjected to cavitation bidistilled deionised water, a solution of Lithium Chloride, a solution of Aluminium Chloride, a solution of Iron Chloride and a solution of Iron Nitrate [4]. Only the two solutions containing Iron emitted neutrons, apparently, without gamma rays above the background level. Besides, the emission of neutrons did not begin as soon as the ultrasounds were turned on. The

⁷This value seems quite big, but it is necessary to refer it to a microscopical region (the active reagon or NAE) and to the macroscopical amounts of energy pumped in the every type of LENR experimental setup

⁸This explains why we have never used deuterated substance, never look for Helium or Tritium and never attempted to measure the presence of extra heat.

⁹Even a short explanation of the differences between the two research tracks would be a digression from the main target of this paper. We only mention here that the collapse of the bubble is not a mean to increase the temperature of its content, but, conversely, a mean to accelerate the ions trapped on its surface towards each other. For a concise but clear explanation please refer to the web site <http://www.newnuclear.splinder.com/tag/towards+clean+nuclear+energy>

first neutron evidences began to appear after 40 - 50 minutes since ultrasounds had been turned on. These two facts, Iron response and the existence of a delayed emission of neutrons¹⁰ (which has been a constant evidence in every experiment) can be referred to the predicted energy threshold. It is possible to hypothesize that the 40 - 50 minutes were the time to reach and overcome the energy threshold. This hypothesis has to be completed with an important detail. Overcoming the energy threshold needs to be referred to the context and the environment where the process takes place and in particular to the types of nuclides involved. The experimental conditions were the same for the three types of nuclides, Lithium, Aluminium and Iron. Only the solutions with Iron emitted bursts of neutrons. This can be interpreted in terms of the two conditions mentioned above (about the overcoming of the energy threshold and the interval of time to release it) by saying that Iron, for some reason, that can be now only conjectured, possesses those peculiar features that make it fulfill, within the experimental conditions, the two prescriptions. The conjecture is that, the collapse of the bubble concentrates energy in a smaller and smaller region of space (which is actually spacetime), making the energy density higher and higher. In this region of spacetime nuclear species are forced. The overcoming of the threshold is achieved by the complementary contributions of the external energy (ultrasounds) and internal energy, i.e. that of the nuclides taking part in the collapse. The first preliminary clue is that the higher the atomic mass the less external energy and the shorter time interval it takes to deform locally the spacetime. This must be considered only a rough and highly incomplete picture¹¹. More variables are certainly involved. It seems that the quantity of bosonic and fermionic isotopes for each nuclide could play an important role as well¹². Despite the incomplete picture, it is possible to state that the results of the experiments on piezonuclear reactions (transmutations and neutrons without gamma rays) described in the first part of this paper are brought about by pressure combined with a mechanism that allows an abrupt release of energy within a suitable interval of time. The pressure is produced by ultrasounds, the mechanism is the collapse of the bubble¹³. Their synergy along with nuclides with high atomic mass form the Nuclear Active Environment (NAE) in our experiments.

Once that pressure¹⁴ and bubble collapse have been identified as the conditions to generate a NAE in piezonuclear reactions, let us try and see if it is possible to spot within different experimental setups, where ultrasounds are not used, the counterparts of pressure and bubble collapse. Many different setups have been used in LENR experiments

¹⁰delayed emission refers to the 40 - 50 minutes mentioned above and has nothing to do with radioactive decay of radionuclides

¹¹Actually, it not clear whether one of the variables is atomic mass or binding energy or binding energy per nucleon.

¹²About the last conjecture, the picture is a lot more complicated since one should distinguish between nuclides that transmute and the results of transmutations

¹³Critical parameters are the dimension of the bubble and the number of ions of the specific nuclide present on the its surface

¹⁴piezo comes from the greek word piezein which means to press

and evidences of nuclear activity have been collected in almost all of them. Due to the initial character of the clues that this paper puts forward, it certainly does not want to be exhaustive. In this sense, it is interesting to concentrate on the evidences collected by an electrochemical cell with Pd/D co-deposition which, first of all, is the LENR technique more similar to that used by Fleischmann and Pons and more over it seems the farthest, in terms of experimental conditions, from the piezonuclear reactions setup. No pressure seems to be involved, no ultrasounds, no cavitations, and from a mere visual and audible perspective, it seems much quieter. All of the evidences reported below refer to Pd/D co-deposition experiments and the corresponding control tests. In particular, we refer to the experimental setup and procedure used by Mosier-Boss et al. which is described in [15]. In their experiments the metals used for the cathode were Ni, Ag, Pt, Au and the solution contained $PdCl_2$ and $LiCl_2$ or KCl_2 in heavy water. In control experiments $PdCl_2$ was substituted for $CuCl_2$. The procedure comprised two phases. During the first part of the electrolysis, Palladium is reduced on the cathode (Ni, Ag, Pt, Au) and gets plated onto it together with Deuterium. Once the Palladium is plated out, the second phase begins. During this part an external static electric or magnetic field can be either applied or not to the cell and the cathodic current is increased. The details that we are reporting here can be extracted from [15, 16, 17, 18] and the references cited in them. Our purpose is to try and look through them in order to make out those features that may corroborate the hypothesis of the existence in the electrolytic technique of a mechanism that may fulfill the two requirements mentioned above about the energy threshold and releasing time. Bubble collapse is a far from equilibrium process where energy is locally concentrated around the surface of the bubble and suddenly released with great intensity. In this regard, we will have to look at the whole electrolytic technique and search for leads pointing toward these three characteristics (far from equilibrium, local loaded energy, local abrupt release of it). In [16] the researchers state that "the experimental protocol covers three time periods". The first is the co-deposition of Pd/D on the cathode which takes place for several hours at different increasing currents; the second period is called "stabilization of the system", when, at increasing different currents, for several hours, the Pd/D ratio of the co-deposition is let distribute uniformly on the cathode; the third period of time is used "to put the system in a far from equilibrium condition". This is done by applying an intense static electric or magnetic field and by letting the electrolysis proceed by keeping increasing the current from time to time. It is fairly reasonable to consider that a co-deposition of Pd/D is in itself an unstable structure in which atomic bonding between Palladium atoms are deformed, stretched, and weakened by the presence of Deuterium. To confirm this, one can put forward the fact that LENR experiments have begun to be carried out in the last few years not by loading Deuterium in bulky Palladium, but rather by co-depositions Pd/D or by nanostructured Pd. These methods produce greater quantities of anomalous evidences than those with solid Pd [8, 15, 19]. Let us look at this unstable structure of Pd/D from the point of view of the hypothesized NAE in which heavy mass number nuclides play a fundamental role.

From this perspective, Palladium would be the main reactant (precursor) while the role of Deuterium, loaded among Palladium atoms, would be to load mechanical energy within Pd¹⁵. Anyway, leaving to further experiments the conjecture of Palladium as the main reactant, that the loading of mechanical energy in Pd is brought about by Deuterium, is confirmed by experiments in which the solution contained $CuCl_2$ instead $PdCl_2$. Copper does not absorb Deuterium, no lattice deformation is brought about, no mechanical energy gets loaded and hence no reactions take place [15]. The statements by Storms [8] in his book seem to move in the same direction. He reports that "...the basic material used as cathode is not active initially even when it is made of Palladium - activation is required. Nevertheless, the base material does affect the morphology and subsequent activity of the deposited layer...". The co-deposition or the nano-structures together with heavy atomic mass nuclides, used in the substrates (Pd, Au, Ag, Pt, Ni...), are some of the ingredients to generate a NAE and in particular those ingredients that allow to store an amount of energy higher than the threshold mentioned above. All of these conjectures can be considered a sound lead¹⁶ from the experimental conditions about the possible fulfilment of the first requirement of LLI breakdown hypothesis: existence of an energy threshold. We concentrate now on the second requirement: the mechanism to release this loaded energy. Very inspiring in this regard, is the discussion in the papers [16, 20]. In [16] the discussion is about the shape change that was noticed in some areas of the cathode at the end of the electrolysis. The unstable structure at the cathode after Pd/D co-deposition with energy loaded mentioned above is a very complicated configuration of electric layers which, if the current were stopped, would be in a reasonable macroscopical equilibrium but certainly a feeble microscopical one. The application of the intense electric or magnetic field and the increase of the current shake the microscopical equilibrium and produce hot spots randomly distributed in position and in time all over the cathode. As stated by the researchers in the paper [16], "...a conductor placed in an electric field cannot remain in a stable equilibrium and a negative pressure acts on its surface...". This pressure is the consequence of forces applied to the surface of the conductor, which, due to the Gauss' theorem, is affected by them in its bulk as well. The feeble microscopical equilibrium is due to the complex electrical relation existing among the three components of the cathodic system: the substrate (Ni, Ag, Pt, Au), the co-deposition Pd/D and the solution. First

¹⁵This perspective must be considered only a conjecture sustained only by some experimental evidences of piezonuclear reactions in solids, which will be presented soon. Of course one might wave the evidence that macroscopic outcomes, in terms of transmutations, ionizing radiation, extra heat, were only be obtained where Deuterium was used and that, viceversa, when Hydrogen was used the results were much less evident. However, Deuterium cold fusion explains only very hardly the anomalous outcomes of LENR and CMNS experiments. Conversely, always remaining of a conjectural ground, it is possible to hypothesize that, once the microscopical spacetime has been deformed thanks to presence of a heavy nucleus, like Pd, lighter nuclides may fall into the deformation and take part in the non Minkowskian nuclear reaction. In this non Minkowskian sense Deuterium contributes with one neutron more than Hydrogen.

¹⁶A lead in the sense that deeper investigation, experimental, theoretical and phenomenological will have to be carried on from this point.

of all this dynamically unstable relation is established by the electric potential differences which can be synoptically represented by the Fermi level and the redox potential of the three components and second by the presence of Deuterium and its continuous supply. Deuterium moves within Palladium and this exposes the latter to local gradient of pressure. Along with it, the flow of an increasing current alters the electric equilibrium and generate local forces and hence pressures. Besides, one might think that if the electrolytic current is not stable but presents brief and maybe small variations (small spikes), they produce gradients of magnetic field which, on their side, induce gradients of pressure¹⁷. We reckon that, from the picture presented above, it is fairly reasonable to hypothesize that within the electrolytic technique with Pd/D co-deposition there exist local experimental conditions compatible with those found in piezonuclear reaction experiments where cavitation took place. As a bubble is local frail inhomogeneity within a liquid which can be squeezed and deflated¹⁸ by squeezing it by ultrasounds, the locally frail structure of Pd/D co-deposition presents local inhomogeneities or hollows (e.g. gradients of the density of Pd and/or D atoms) whose sudden and violent¹⁹ collapse can be induced by bringing the systems to a far from equilibrium condition (electric or magnetic field, periodical increase of current, continuous flow of Deuterium with the co-deposited layer.) As Iron atoms (not light elements) are entrapped in the interface gas/liquid of bubbles and are launched against each other during the collapse and forced in a smaller and smaller volume of spacetime until the energy threshold is reached and overcome in a precise interval of time, Palladium atoms might endure similar processes as hollows in Pd/D co-deposition are made collapse. One more mental picture can be added to the scenario. Let's imagine that these conditions are established in one point of the Pd/D co-deposition, and that these processes take place there²⁰. These processes in one point might trigger other similar processes in points of Pd/D not too far from it. It would be a bit as if a balanced seesaw were outweighed on one side (external cause like current or fields) and, as it touches the ground, it triggered a slight explosion, which would thrust this part upwards and the opposite one downwards which, in turn, would trigger a second explosion, and so on. Many an evidence has been collected by different experimental techniques compatible with processes or NAE that are randomly distributed all over Palladium (hot spots, concentrated evidences of charged particles, concentrated presence of anomalous transmutation products). Control experiments with Copper instead of Palladium are in favor of these hypotheses since Copper does not absorb Deuterium and hence no suitable structures

¹⁷Although one may think that these gradients of magnetic field are small, they have to be imagined applied to microscopical regions

¹⁸We remind that in our phenomenological model the generic bubble deflates while being squeezed by a shockwave. In other words it is not treated as mean to compress the gas contained in it in order to reach hot fusion conditions.

¹⁹The rapidity and force of the collapse will be two of the many parameters that will have to be estimates, however the violence here refers to the microscopical region where pressure is applied

²⁰There is no need for imagination, at least for the processes, since this is what comes out from all of the evidences.

with hollows or gradients of density are formed [15]. Besides, when bulk Palladium is used instead of Pd/D co-deposition, some evidences are obtained but far less than with the latter [15]. In [8] cracks are indicated as "...the only environments obviously common to all successful experiments...". Always in [8] it is said that Palladium expands as it is loaded with Deuterium and cracks of different dimensions form during this process. Cracks are said to be present in Pd/D co-depositions or Palladium black. Some questions are raised as to how cracks are involved in the cold fusion process, or as to how cracks operate to allow Coulomb barrier penetration, or as to how dimensions of cracks influences the formation of a NAE. Eventually, cracks are said to be good candidates to be a NAE. According to our theory and hence according to our hypotheses, the NAEs that form in our experiments and in all of the LENR/CMNS experiments do not trigger well known nuclear processes and we believe that this is a fact more than corroborated by loads of anomalous evidences. Moreover, our theory predicts, although at an initial level, that these new nuclear processes cannot be account for by the well known laws of (nuclear) physics. Conversely, since local Lorentz invariance breakdown and spacetime deformation take place, all the concepts like Coulomb barrier, that belong to a flat spacetime, may not be suitable to describe both qualitatively and quantitatively these new processes. Nuclear spacetime deformation which, according to us is the heart of these phenomena, has been discovered to be brought about by pressure and an energy releasing mechanism (cavitation in our experiments) which succeed in creating those conditions mentioned above that are the overcoming of the 367.5 GeV energy threshold and the release of this energy in a precise interval of time. Under this point of view, cracks are the equivalent of bubbles. However, the important part is how rapidly and forcibly these cracks (hollows) are made collapse [21, 22] and in this sense the dimensions of the crack play their role. Before concluding, we would like to point out one more thing. We said that, high atomic mass nuclides contribute to facilitate the overcoming of the energy threshold when they are forced in a smaller and smaller region of spacetime. This qualitative picture may induce to think that starting from Palladium, one should obtain heavier nuclei like in a sort of new type nuclear fusion. If it were like this, the evidences would be against. In [16] it is reported of transmutations whose products were Aluminium, Magnesium, Chlorine, Silicon which are all lighter nuclides than Palladium. Since these transmutations are thought to be brought about by spacetime deformation, it is possible that a heavy nuclide be ripped apart into lighter nuclides by tidal forces i.e., in more picturesque way, as an astronaut would be as he were falling into a blackhole.

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